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EXPLORATORY TUNA FISHING IN THE MARSHALL ISLANDS

SPECIAL SCIENTIFIC REPORT: FISHERIES No. 47

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

United States Department of the Interior
Oscar L. Chapman, Secretary
Fish and Wildlife Service
Albert M. Day, Director

Special Scientific Report - Fisheries
No. 47

EXPLORATORY TUNA FISHING IN THE MARSHALL ISLANDS

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Pacific Oceanic Fishery Investigations

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1/ From South Sea Fishery News [Nanyō Suisan Jōhō], Vol. 5, No. 1, pp. 6-9. 1941.

2/ From Progress Report of the South Seas Government-General Fisheries Experiment Station [Nanyōchō Suisan Shikenjō Jigyō Hokoku] for 1923-1935.

A Survey of Tuna Fishing Grounds in the Marshall and Caroline Islands

Since the end of 1938, when a large number of Japanese fishing vessels began to operate among the South Sea Islands, the tuna fishing grounds of these islands have attracted the attention of the world.

At present, however, the area where the Japanese tuna vessels fish is limited to one section of the central Caroline group. The principal fishing grounds, in general, lie between 144° E longitude (near Woleai Island) and 153° E longitude (near Namoluk Island) and between the Equator (0°) and 7° N latitude (near Truk), although recently there have been indications of a gradual shift eastward. This area is washed by the Equatorial Counter-current. The object of this survey conducted by the Zuihō Maru was to determine whether good tuna fishing grounds exist in the Equatorial Counter-current area to the east and south of Ponape, Kusaie, and Jaluit Islands.

The survey group departed from Palau on 10 November last and returned on 28 December; a total of 49 days was spent on this survey. Since the detailed report on this survey is at present being compiled separately, a rough report is submitted here as a reference for persons and industries concerned.

Brief description of the fishing grounds.

No. 1. This fishing ground is located about 55 miles west of Woleai Island and, judging from the WSW flow of the current, is in the Equatorial Current area. Since this vessel had other official business to attend to at Woleai, the survey of this location was conducted en route to that island. The survey group expected little from this ground; consequently, only 20 baskets were used.

No. 2. This fishing ground is located about 130 miles SE of Woleai and south of Ianthe Shoal. The E/S flow of the current clearly indicates that it lies within the Equatorial Counter-current. One hundred baskets of tuna longlines, each having six hooks, were used, making a total of 600 hooks fished. The types of fish caught are shown in the table and the catch ratio was 1.5. [TN. The catch ratio is the number of tuna and spearfish taken per 100 hooks fished.]

No. 3. This ground is located about 110 miles SE of No. 2 fishing ground or about 240 miles SE of Woleai. The E/S flow of the current clearly indicates that it lies within the Equatorial Counter-current. A rather swift flow is indicated by the velocity of one knot. A total of 100 baskets were used and the tuna catch ratio of 9.3 indicates that the results were good.

No. 4. This fishing ground is located about 100 miles S/W of Truk and, judging from the SE/E flow of the current, is also within the Equatorial Counter-current. Because of the condition of the fish hold, the number of baskets used was cut down to 50. The catch ratio was 5.0, which indicates a good fishing ground.

No. 5. This fishing ground is located about 120 miles SE of No. 4 or about 200 miles SSE of Truk. The easterly flow of the current clearly indicates that it too lies in the Equatorial Counter-current area. The

catch ratio was 6.3, which indicates that this ground is richer than No. 4. The fact that more big-eyed tuna were found than yellowfin is a singular phenomenon.

No. 6. This fishing ground is located about 125 miles SE of No. 5 or about 320 miles SSE of Truk and north of Greenwich. The ENE flow of the current clearly indicates that it lies within the Equatorial Counter-current. As in the case of No. 5, 50 baskets were used. In one set 68 yellowfin and 3 black marlin were caught; this means a ratio of 23.7 and indicates a good record. I believe that this catch ratio of 23.7 is almost an epochal record for the Zuihō Maru.

No. 7. This fishing ground is located about 90 miles S/E of Ponape Island. A catch ratio of 5.8 indicates that it is a fairly good fishing ground. Numerous big-eyed tuna were caught, but not one yellowfin was taken.

No. 8. This fishing ground is located about 125 miles SE of No. 7 or about 210 miles SSE of Ponape. The southeasterly flow of the current clearly indicates that it lies in the Equatorial Counter-current area. Although the number of baskets used was reduced to 40, 45 yellowfin were caught. The catch ratio of 19.2 indicates a rich fishing ground.

No. 9. This fishing ground is located about 120 miles E of Kusaie I. This ground was tested during the vessel's voyage to Jaluit I. The fishing ground was not as good as we expected.

No. 10. This fishing ground is located about 130 miles S/E of Jaluit. Judging from the easterly flow of the current, it lies in the Equatorial Counter-current area. The number of baskets used was 80 or twice as many as the previous time. In one set 73 yellowfin were caught. The catch ratio of 18.1 indicates that this ground abounds in fish.

Summary

This survey was conducted on only eight selected fishing grounds within a wide sea area (about 345,600 square miles) between 146° and 170° E longitude and between 2° and 6° N latitude. Excluding the fishing ground located 120 miles east of Kusaie I., which had a catch ratio of 1.3, the fishing grounds all showed catch ratios greater than 5; the highest was 23.7 percent. This fully proves that tuna occur abundantly in this area. There is no doubt that the results of this survey will contribute greatly to the development of the tuna fishing industry in the islands.

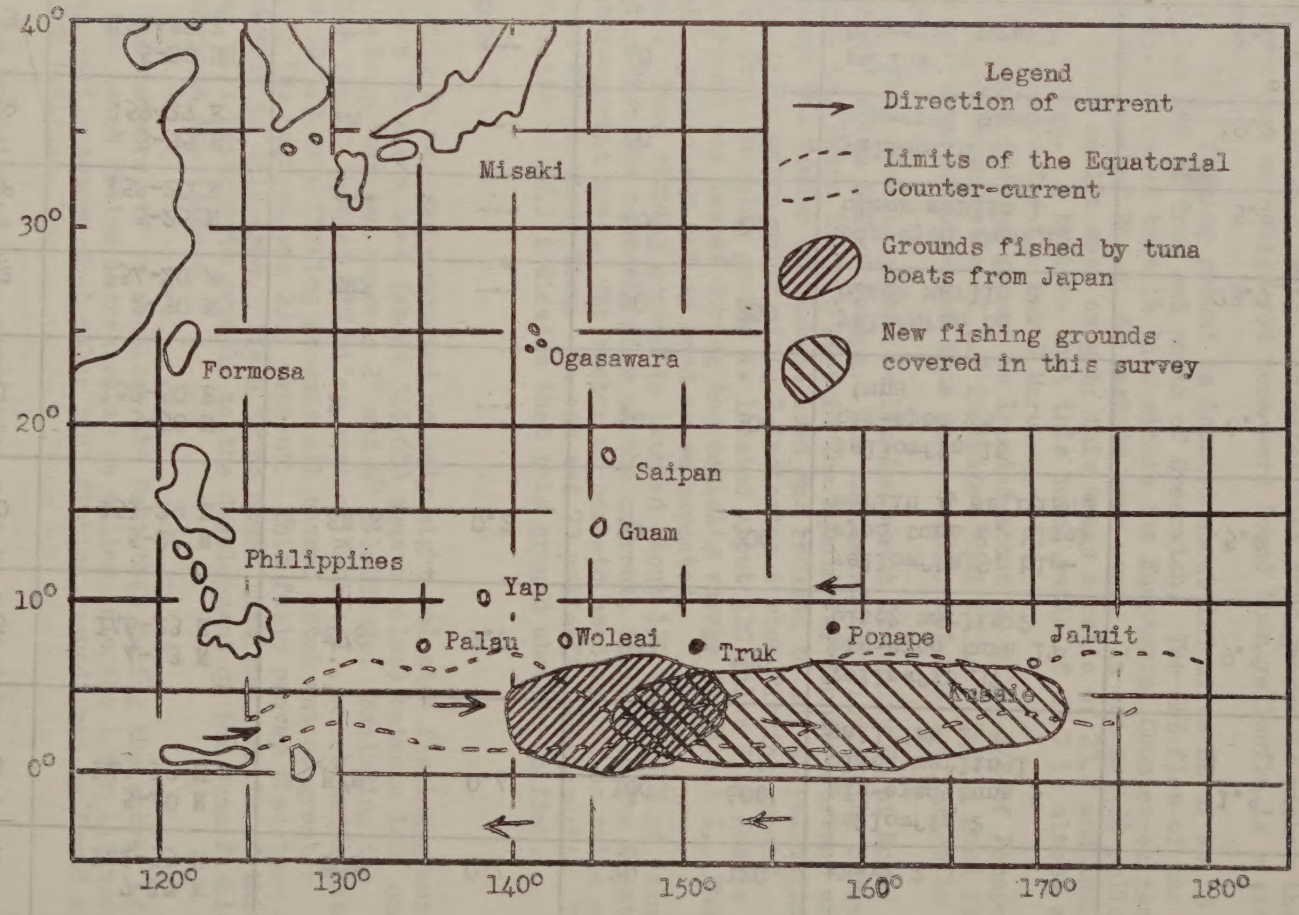
Furthermore, if we consider the fact that during the survey of the area the catch ratios increased as we sailed into the lower latitudes, we can easily assume that other rich fishing grounds can be found south of 2° N latitude.

The validity of this assumption must be tested by a later survey.
(January 18)

(Note) Only tunas and spearfishes are recorded on the following table under the heading of types of fishes caught. Skipjack and sharks are omitted.

No.	Month	Day	Position of Fishing Ground	Current Direction	Current Velocity	No. of Baskets used	No. of Hooks used	Species and Number of Fish Taken	Tuna Catch Ratio (including spearfish)
1	Nov.	12	7-17 N 142-53 E	WSW	0.4	20	120	shark 2	---
2	Nov.	14	5-40 N 145-13 E	E/S	0.4	100	600	yellowfin 2 big-eyed tuna 5 black marlin 1 sailfish 1	1.5
3	Nov.	15	4-13 N 146-23 E	E/S	1.0	100	600	yellowfin 37 big-eyed tuna 17 black marlin 2	9.3
4	Nov.	20	5-28 N 151-29 E	SE/E	0.2	50	300	yellowfin 9, big-eyed tuna 4, black marlin 1, sailfish 1	5.0
5	Nov.	21	3-56 N 152-50 E	E	---	50	300	yellowfin 15 big-eyed 45 tuna	6.3
6	Nov.	22	2-30 N 154-20 E	ENE	---	50	300	yellowfin 68 black marlin 3	23.7
7	Nov.	28	5-25 N 158-20 E	---	---	40	240	big-eyed tuna 13 black marlin 1	5.8
8	Nov.	29	3-35 N 159-27 E	SE	---	40	240	yellowfin 45 big-eyed tuna 1	19.2
9	Dec.	3	5-20 N 164-59 E	---	---	40	240	yellowfin 2 big-eyed tuna 1	1.3
10	Dec.	6	3-45 N 169-40 E	E	---	80	480	yellowfin 73 big-eyed tuna 7 black marlin 7	18.1

Chart of Tuna Grounds



Marshall Islands Fishery Investigations 1926-27

Purpose

The Marshall Islands comprise two chains of islands, the Ralik and the Ratak, which are located in the easternmost part of the Japanese South Seas. This is a virgin fishing ground where no fishery investigations have ever been made. All that we have are scattered reports from mariners of having seen whales and schools of tuna near the islands. The present paper is a report of investigations, chiefly of tuna, carried out during 1926 and 1927 in cooperation with the Fisheries School of the Ministry of Agriculture and Forestry.

Fishing Gear

1. tuna longlines
2. tuna trolling lines (ordinary trolling lines)
3. stick-held net [bōkeami] (for bait investigation)

The construction of the above gear was of the ordinary sort and therefore the description of it is omitted.

Research Vessel

The investigation was carried out during training cruises of the Fisheries School's training vessel Unyō Maru.

General Outline of the Investigations

This investigation was divided into two periods during each of which a technologist was stationed aboard the research vessel by the Government-General.

First Period	from December 6, 1926 to January 9, 1927	Ralik Chain
Second Period	from December 23, 1927 to January 23, 1928	Ratak Chain

RALIK CHAIN INVESTIGATION

General Description of the Fishing Grounds

The area covered by this investigation has never before been the subject of an organized fishery investigation, and is a completely virgin fishing ground. Judging by the eye-witness accounts of mariners, the reports of the catches made by the natives, and so forth, it appears that in general, the Ratak Chain is superior as a fishing ground to the Ralik Chain. It is said that the waters near Mili and Mejit are particularly rich in fish, and it is reported that whales are often sighted near Arno Atoll.

The best catches in the Ralik Chain have hitherto been made at Ailinglapalap and Kili atolls, the waters near Kili appearing particularly promising.

Methods

Two fishing boats were used, with the Fisheries School training vessel Unyō Maru (444 tons, 330 rated horsepower) as tender. Eighteen baskets of Bōshū type tuna longline with six hooks to a basket were used. Bait was frozen squid from Japan.

General Description of the Gear

Mainline 160 fathoms
Float-lines 2 lines each 10 fathoms long
Hooks 6
Distance between float-lines and branch-lines 20 fathoms
Branch-lines
Long 13½ fathoms (line 10 fathoms, cotton-wrapped hemp 3½ fathoms, wire 1 fathom)
Short 6 fathoms (line 1½ fathoms, cotton-wrapped hemp 3½ fathoms, wire 1 fathom)
Position of hooks in the water (estimated)
Long branches 48 fathoms deep
Short branches 27 fathoms deep

Progress

Experimental fishing grounds were selected in comparatively calm areas in the lee of the islands about 1 to 5 miles off the reef, taking into consideration the movements of the schools, the difficulty or ease of navigation, the number of trials which were to be made, and the safety of the fishing vessels.

Bait

The bait was refrigerated squid brought from Japan in the Unyō Maru's cold storage. Flying fish and all sorts of reef-fish are generally distributed throughout these islands and can easily be taken for bait.

General Results at Each Fishing Ground

I A yellowfin was taken on the long branch-line nearest the reef.

II One flat-headed shark [Scoliodon walbechmi]; some baits taken.

III A third of the baits were taken, especially on the short lines. The current offshore set NE. Inshore there was a slow countercurrent.

IV 1 to 5 miles off the reef. East SE current. According to the natives many tuna are taken by trolling in the vicinity. Saw flying fish flying near the entrance to South Pass.

V One yellowfin on a long branch of the fourth basket from the reef (about 1.5 miles). Current S, rather swift.

VI Weather calm, no current, position of gear did not change. Almost all of the baits were untouched.

VII 0.5 to 3 miles off the reef. Nothing to report.

VIII 0.5 to 5 miles off the reef. Rapid current running NE along the coast, somewhat slower offshore. Speed of current 0.5 to 2 knots. One yellowfin on a long branch, and one spearfish and one okisawara [unidentified cybiid] on short branches.

IX 1 to 6 miles off the reef.
Immediately after getting the gear in the water a 70-kan [578.9 lb.] marlin was taken on a short branch of the section of line nearest the reef. There had been heavy rain since the previous evening. The current was NE, about 1.5 knots, slower offshore.

X 1 to 6 miles off the reef.
No catch. Occasional showers.

XI 2 to 6 miles off the reef.
With 16 baskets of line in the water, a spearfish was taken on the ninth section of line from the reef. Current N, 1 knot. Strong wind, showers.

XII 1 to 2 miles off the reef.
No catch. Slow NE current. Weather bad, occasional showers.

XIII 16 sections of line used. Two yellowfin were taken on long branches of the second and eight sections from the reef. Current NE, 1.5 knots. Weather calm but distant lightning was seen. Water temperature 50 fathoms below the surface was measured and found to be 26.3 C., identical with the body temperature of the tuna which had been taken. Consequently it was considered that this was the depth at which the tuna were swimming, and the hooks were lowered 10 fathoms.

XIV 1 to 2 miles off the reef.
One yellowfin was taken on a long branch of the second section of line of eight sections used (two boats working together operated 16 sections of line). Current following the coast N, 1.5 knots. Weather calm with occasional showers. Beginning this time we attached floats to only half of the float-lines and got better results.

XV Operated 16 sections of line. Yellowfin were taken on the eighth and the eleventh from the reef. One spearfish was taken on the 16th section. The currents were irregular and the main line got tangled up.

XVI Nothing to report.

The log of the fishing operations is shown in the attached table.

Results

Horizontal distribution of the tuna.

From the results of this study, it appears that the tuna occur close to the reef, while the spearfish are found farther offshore. The former are most numerous within 1 to 3 miles of the reef, the latter at distances greater than 3 miles offshore. The greatest number of fish are caught off channel entrances, and where currents meet off the angles and points of islands. No trials were made in the open sea away from the influence of the islands, because of the shortage of time and personnel, and so unfortunately no opinion can be given as to the worth of such fishing grounds.

Vertical distribution of the tuna.

The tuna appear to occur at depths of 50 to 60 fathoms in this archipelago.

1. Determined by correlating oceanographic observations with the body temperature of tuna (taken immediately after capture and before the fish died).
2. Tuna were taken on the long branches with hooks at a depth of about 50 fathoms.
3. When the gear was altered to put all of the hooks down to 50 fathoms, the catch increased.

Our conclusions are deduced from the above points and, although no final decision can be made yet, it is thought that this matter is worthy of study.

Density of the tunas

It would be premature to determine the density of the tuna population in the area on the basis of this one study, but from our results it is difficult to see where the density is remarkably greater than that found in Japanese waters. The results may be conveniently summarized as follows:

Number of operations		20	
Number of times there was no catch		7	
Largest catch	Yellowfin	2	(206.75 lbs.)
	Spearfish	1	(90.97 lbs.)
Gear used	average	16	baskets

Remarks

A study like this one is necessarily very different from a commercial operation. Because we continually moved on from one fishing ground to another and did not regulate the length of our stay on a particular ground according to the good or bad catch which we made there, our catch ratio was comparatively poor. If we were to rely on this catch ratio to discover the best fishing grounds, and try to imagine the amount of fish which

would be taken by commercial operators, it would be as follows:

Calculated for one month of operations with a 20-ton fishing boat

Number of times fished	30 times
Number of times no catch	10 times
Average catch per operation	827 pounds
Gear used	45 baskets

This would give a monthly catch of 16,540 pounds, which compares with the highest catches made in Japanese waters.

Table of Catch

Station	Species	Number	Weight [Unit?]	Food	Processing
1	shark	2	1300	reef-fish	
	cybiid	1			
2	shark	1			
3	spearfish	1	0500		
4	squid	1			
5	cybiid	2	700		oil 395
			850		
6	———				
7	shark	5			
8	shark	1			
	dolphin	1			
	big-eye	1	300		
	cybiid	1	800	skipjack	oil 3
	spearfish	1	1000		oil 34
9	spearfish	1	750	reef-fish	water 292
10	———				
11	spearfish	1	46		water 147
12	———				
13	big-eye	2	1600		
			300		oil 47
14	spearfish	1			
	dolphin	2	2200		
15	spearfish	1	1100		
	big-eye	1	1400	squid	
	yellowfin	1	1300	reef-fish	
16	spearfish	1	1300		water 49
17	big-eye	2	2050		
			1050		
18	———				
19	big-eye	1	2000		
20	big-eye	1	2000		

Daily Log of Ralik Chain Tuna Investigation
December 1926

Date	Fishing Ground	Operation	Number of Fish Taken	Sea Temp.	Weather	Notes
6	Rongelap	longlines	1	28.9	clear	1 fish, 107.5 lbs.
7	Rongelap	"	-	27.8	"	
13	Jaluit	"	1	28.9	"	
14	Ailinglapalap	"	-	29.0		
15	Ailinglapalap	"	2	28.5	"	1 fish 57.9 lbs. 1 fish 70.2 lbs.
16	Ailinglapap	"	-	28.9	"	
	Wotja	"	-	28.5	cloudy	
17	Wotja	"	2	28.5	clear	1 fish 57.9 lbs. 1 fish 24.8 lbs.
18	S of Namu	"	1	27.0	rain	1 fish 62.9 lbs.
19	S of Namu	"	-	28.4	cloudy	
20	N of Namu	"	1	28.2	"	1 fish 380 lbs.
21	S of Kwajalein	"	2	28.1	"	1 fish 132 lbs. 1 fish 24.8 lbs.
22	N of Kwajalein	"	1	28.0	"	1 fish 182 lbs.
24	Wotja	"	-	28.2	rain	
25	Ailinglapalap	"	3	28.7	cloudy	1 fish 91 lbs. 1 fish 116 lbs. 1 fish 108 lbs.
26	Ailinglapalap	"	1	28.7	"	1 fish 108 lbs.
			January 1927			
4	W end of Jaluit	longlines	2	28.5	cloudy	1 fish 8.3 lbs. 1 fish 165 lbs.
5	S end of Jaluit	"	-	28.4	"	
9	Kusaie	"	-	28.7	"	
15	near Ponape Channel	"	1			1 fish 207 lbs.

Table of Experimental Fishing

Station Number	Date	Place	Position		Time	
			Longitude	Latitude	Left Ship	Set Line
1	12- 6 evening	Rongelap	166-41°E	11-9° N	4:50	5:00
2	12- 7 morning	Rongelap	166-51°E	11-7° N	4:50	4:55
3	12-13 evening	Jaluit	169-30°E	5-51° N	5:00	5:05
4	12-14 evening	Ailinglapalap	168-45°E	7-15° N	5:30	6:00
5	12-15 morning	"	168-42°E	7-16° N	4:30	5:00
6	12-16 morning	"	168-42°E	7-16° N	4:30	4:55
7	12-16 evening	Wotja	168-30°E	7-25° N	5:15	5:25
8	12-17 morning	"	168-71°E	7-25° N	4:30	5:10
9	12-18 morning	S of Namu	168-12°E	7-48° N	9:30	10:05
10	12-19 morning	"	168-12°E	7-48° N	4:30	5:05
11	12-20 morning	N of Namu	167-51°E	8-11° N	4:30	5:00
12	12-21 morning	S of Kwajalein	167-35°E	8-48° N	4:30	4:55
13	12-22 evening	N of Kwajalein	167-31°E	8-58° N	4:30	5:05
14	12-24 morning	Wotja	168-32°E	7-25° N	5:00	5:15
15	12-25 morning	Ailinglapalap	168-42°E	7-16° N	4:30	5:00
16	12-26 morning	"	168-42°E	7-16° N	4:30	4:55
17	1-4	W end of Jaluit	169-24°E	5-57° N	5:00	5:05
18	1-5	S end of Jaluit	169-34°E	5-43° N	5:50	5:55
19	1-9	Kusaie	162-57°E	5-12° N	5:14	5:20

Table of Experimental Fishing (Continued)

Station Number	Time Took in Line	Time Returned to Ship	Number of Boats	Number of Baskets	Weather	Wind Direction	Wind Force
1	8:30	9:00	2	16	B	ENE	2
2	7:30	8:00	2	16	B	NE	3
3	8:15	9:00	2	16	B	ES	2
4	8:20	9:00	1	14	B	NE	2
5	8:30	9:00	2	8	B	WE	1
6	8:05	9:00	2	14	B	NNE	2
7	8:25	9:20	1	16	C	ENE	2
8	8:30	8:50	3	8	B	NE	3
9	12:50	1:24	2	20	R	NNE	1
10	7:45	9:00	2	14	C	NE	4
11	8:05	8:30	3	16	C	NE	4
12	7:55	8:50	2	20	C	NE	3
13	7:45	8:00	2	16	C	E	2
14	7:50	8:20	2	16	R	E	2
15	7:50	8:20	2	16	C	NE	2
16	8:45	9:00	2	15	C	NE	2
17	8:00	8:40	2	16	C	NE	3
18	8:00	8:40	2	16	C	NE	4
19	7:42	8:35	2	16	C	E	3

Station Number	Direction of Current	Atmospheric Pressure	Atmospheric Temperature	Sea Water Temperature						Bait
				Surface	-10	-25	-50	-100	-200	
1		760	78	27.6	28.1	28.0	25.5			100 squid
2		760	76	27.8	28.1	28.0	27.8			100 "
3		757	77	28.6	28.8	28.9	28.6			100 "
4		759	78	29.0						50 "
5		758	78	28.5						100 "
6	W	758	80	28.9	28.8	28.5	27.5			100 "
7		757	80	28.5	28.4	28.2	25.8			50 "
8		7585	78	28.5	28.4	28.2	25.8			130 "
9		759	72	27.0						100 "
10		759	78	28.4	28.4	28.4	26.5			100 "
11		758	77	28.2	28.2	28.1	27.1			130 "
12	E-W	757	77	28.1	28.2	28.2	26.3	13.7	10.3	100 "
13	S-N	756	75	28.0	28.2	28.0	27.1			100 "
14	S-N	757	75	28.2	28.5	28.5	27.5			100 "
15	S-N	756	84	28.4						100 "
16	S-N	758	77	28.7	28.7	28.6	26.6	13.8	9.8	100 "
17	N-S	758	75	28.5						100 "
18	W-S	757	76	28.4	28.5	28.5	28.4	19.8	11.2	100 "
19	S-N	757	73	28.8	28.8	28.5	28.5	20.6	10.2	100 "

III S of Utirik atoll, 1.5 miles off the reef
No catch, rough weather made operation difficult. It is said that at certain seasons many tuna migrate into these waters, and in May and June many schools of green sea-turtles appear. Pearl oysters and tridacna are abundant.

IV W of Ailuk atoll, 1 mile off the reef
No catch, yellowfin said to be abundant around October.

V N of Wotje, 2 miles off the reef
6 yellowfin, 1 cybiid, 1 shark
Adverse currents and rough weather made operation difficult.

VI N of Erikub, .5 mile off the reef
1 big-eye, 2 yellowfin
Sea and wind high, operated in lee of island.

VII SW of Erikub, 1.5 miles off reef
No catch.

VIII SW of Wotje, 2 miles off reef
1 yellowfin
Sea and wind high, operation impossible, especially off entrance to passes.
It is thought that there is no great difference between the results obtained in day and night operations.

IX N of Maloelap atoll, 2 miles off the reef at Kaven Island.
1 shark

X N of Maloelap, 2 miles off reef
No catch
Weather bad, discontinued operations.

XI SW of Maloelap entrance to pass
1 yellowfin
Iwashi were taken inside the reef and used for bait along with the squid. They gave better results than the squid. Currents were fast and fouled up the gear.

XII Arno atoll, near Ine anchorage, 1 mile off the reef
No catch

XIII Aur atoll, N of Ine anchorage, 2 miles off the reef
1 sailfish
Current N, swift

XIV S of Aur atoll, 2 miles off the reef
1 yellowfin, 1 shark
Current S, fast

XV S of Aur atoll, 2 miles off the reef
1 yellowfin
Weather good but currents bad. The natives of the locality catch yellowfin pole-fishing.

XVI S of Mili atoll, 0.5 mile off the reef
1 big-eye, 1 spearfish
Weather calm, current gentle, spearfish were seen leaping in the vicinity.

XVII W of Mili atoll, 1 mile off the reef
1 yellowfin
Weather clear, sea calm, current N 1/3 knot

XVIII S of Mili Island, 0.5 miles off the reef
1 yellowfin
It was planned to set the gear in the entrance to Tokowa Pass, (a good fishing ground near Mili Island), but this was impossible because of strong winds and high seas. Mili Island has the reputation of being the best tuna fishing ground in the southern Ratak chain. Blackfish were seen cruising in nearby waters. Muroaji [probably Decapturus sp.] are abundant in the lagoon and are easily taken. They are highly suitable for bait.

Observations

As was shown in last year's Ralik chain investigation, fish occur most abundantly around the promontories of islands and near the entrances to channels. It is thought that food is comparatively abundant at such places because of the currents and for other reasons. This investigation, like last year's, extended over only a short period of time and included only eighteen trials. It is to be regretted that no data were gathered on operations on the open sea away from the islands.

Wotje occupies an approximately central position in this chain. It is felt that in general better catches are made north of Wotje than are made in the southern part of the chain.

However, the waters adjacent to Mili atoll are thought to be a promising fishing ground.

Horizontal Distribution of Tuna

Roughly the same as in the previous year's investigation and therefore omitted.

Vertical Distribution of the Tuna

The water temperatures at approximately 50 to 60 fathoms are thought to be suitable for tuna and spearfish. These temperatures are 26 to 29 degrees C. and do not differ much from the surface temperatures.

However, we heard that around the entrance to Jabor Pass at Jaluit atoll 100 fathoms is the best depth for catching tuna, and from this we judge that perhaps somewhat greater depths than we have been fishing would be more suitable. In other respects our observations are roughly the same as last year's.

Results

As described above, this Marshall Islands fishery investigation consisted of only two expeditions, however, the results we have obtained indicate that tuna are abundant throughout the area and that many occur in the waters near the coasts of the islands.

Natives and resident Japanese generally say that the fishing season is during the northeast trades, but some say that it is during the calm season.

It is difficult to affirm either of these theories, but at any rate there are evidence that fish are abundant throughout the four seasons and that they are taken at all times.

More spearfish and big-eye were taken in the Ralik chain, while more yellowfin were taken in the Ratak chain. It would be premature to make any generalizations from this on the distribution of fishes in the two chains of islands, however, it appears that in both groups the density of the fish population is greater in the northern than in the southern part. It can be said that oceanographic conditions are generally identical in the two chains.

The sparsely scattered distribution of the schools throughout the archipelago seems to reflect a condition which is common everywhere in the South Seas.

Baitfish are fairly abundant around the shores of all the islands and are easily taken, a circumstance which favors the fishery.

Now that the promising prospects of the Marshall Islands tuna fishery have been recognized, as outlined above, it is essential that further studies be carried out to select the best fishing grounds and provide guidance for the development of the fishing industry in the islands.

Daily Log of Ratak Chain Tuna Investigation
December 1927

Date	Fishing Ground	Operation	No. of Fish	Water Temp.	Weather	Notes
23	W of Taongi	longlines	2	26.0	clear	1 fish 91 lbs.
		trolling	1			1 fish 17.1 lbs.
24	[no fishing]			25.0	50% clear	
25	SW of Bikar	longlines	1	27.3	clear, then cloudy	1 fish 41.4 lbs.
26	S of Utirik	"		27.5	clear	
27	[no fishing]			28.0	clear	
28	W of Ailuk	"		27.5	"	
	W of Wotje		6	27.5		134 lbs. average
29	[no fishing]			28.0	"	
30	[no fishing]			28.0	"	
		January 1928				
1	[no fishing]			28.0	half clear	
2	"			27.0	clear	
3	"			28.0	cloudy	
6	Wotje	bait-net, beach seine, trolling			cloudy	investigating miscellaneous fishes
7	N of Erikub	longlines	4	27.2	"	1 fish 24.8 lbs.
8	SW of Erikub	"		27.6		1 fish 99.2 lbs.
9	SW of Wotje	"	1	27.5	"	1 fish 82.7 lbs.
10	N end of Maloelap	"		27.7	"	
	near Kaven I.			27.5		
11	[no fishing]			27.7	"	
14	"			27.5	"	
15	SW of Maloelap	"	1	27.5	"	1 fish 16.5 lbs.
16	[no fishing]	"		28.0	"	
17	Arno (Ine)	longlines		27.8	clear	
18	N of Arno	"	1	27.8	"	1 fish 49.6 lbs.
19	S of Arno	"	1	28.3	"	1 fish 108 lbs.
			1	27.8	"	1 fish 16.5 lbs.
20	W of Mili	"	2	28.4	"	1 fish 16.5 lbs.
						1 fish 132 lbs.
22	W of Mili	"	1	28.0	cloudy	1 fish 33.1 lbs.
23	S of Mili	"	1	28.2	clear	1 fish 41.4 lbs.

Table of Water Temperatures

Date	Position		Temperature				
	E Longitude	N latitude	Surface	10 fathoms	25 fathoms	50 fathoms	100 fathoms
7	169-55	9-10	27.2	27.5	27.4	27.3	20.9
9	169-51	9-26	27.6	27.5	27.5	27.4	20.5
10	170-54	8-54	27.7	27.7	27.8	27.6	18.9
15	171-0	8-37	27.5	27.5	27.5	27.6	15.6
19	171-45	6-57	28.3	28.4	28.1	28.0	16.6
"	171-32	7-4	27.8	28.0	28.8	27.4	17.0
20	171-43	6-8	28.4	28.5	28.4	28.2	15.4
22	171-56	6-3	28.0	28.2	28.2	28.2	21.2
23	171-43	6-6	28.2	28.2	28.0	27.7	19.8

Table of Experimental Fishing /Ralak Chain/

Station No.	Date	Place	Position		No. of Boats	No. of Baskets	Weather	Wind Direction
			Long.	Lat.				
1	12-23 evening	West of Taongi	168°55'E	14°34'N	2	16	B	NE
2	12-25 evening	Bikar	140°04'E	12°11'N	2	16	B	NE
3	12-26 evening	Utirik	169°48'E	11°12'N	3	20	BC	NE
4	12-28 morning	Ailuk	169°52'E	10°21'N	2	16	B	NE
5	12-28 evening	Wotje	"	9°25'N	2	16	B	NE
6	" evening	North of Erikub	169°55'E	9°10'N	2	16	B	ENE
7	1-8 morning	South of Erikub	170°01'E	9°01'N	2	16	C	NE
8	1-9 forenoon	Wotje	169°51'E	9°26'N	3	20	B	NE
9	1-10 morning	West of Maloelap	170°51'E	8°50'N	2	16	B	NE
10	1-10 evening	"	"	"	2	16	BC	NE
11	1-15 evening	Southwest of Maloelap	171°50'E	8°32'N	2	16	BC	NE
12	1-17 morning	Arno (Ine)	171°45'E	6°53'N	2	16	B	ENE
13	1-18 morning	"	171°57'E	"	2	16	BC	NE
14	1-19 morning	"	171°45'E	6°51'N	2	16	B	NE
15	1-19 evening	"	171°32'E	7°04'N	2	16	CB	ENE
16	1-20 evening	Mili	171°43'E	6°08'N	2	16	B	ENE
17	1-22 evening	"	171°56'E	6°03'N	2	16	C	ENE
18	1-23 evening	"	171°43'E	6°06'N	2	16	B	ENE

Table of Experimental Fishing [Ratak Chain] (Continued)

Station No.	Wind Force	Atmos. Pressure	Air Temp.	Water Temperatures					Clarity	Times Set Line	
				Surface	10	25	50	100		Start	Finish
1	2	758.5	75.0	26.0	26.0	26.0	26.0	22.7	30m	5:55	6:30
2	3	758.0	77.0	27.3	27.3	27.5	27.5	18.8	30	5:40	6:23
3	2	758.0	76.0	27.5	27.3	27.0	27.5	19.5		5:50	6:30
4	2	758.0	77.0	27.5	27.5	27.5	27.2	16.7	39	7:00	7:20
5	2	758.0	79.0	27.5	27.8	27.5	27.6	19.9	24	4:30	5:00
6	3	758.0	77.0	27.2	27.5	27.4	27.3	20.9	19	5:40	6:45
7	2	758.0	77.0	27.6	27.5	27.6	27.5	18.4	23	4:35	5:40
8	3	759.0	77.0	27.5	27.5	27.5	27.4	20.5	25	7:40	8:50
9	3	758.0	78.0	27.7	27.7	27.5	27.6	18.0	28	5:10	5:45
10	3	757.0	80.0	27.5						6:00	6:20
11	4	755.7	78.0	27.5	27.5	27.5	27.5	15.6	20	3:00	6:00
12	1	756.0	78.0	27.8						4:55	5:20
13	2	755.5	77.0	27.8						5:00	6:00
14	1	756.0	76.0	28.3						5:00	5:40
15	3	754.5	79.0	27.8	28.0	27.8	27.4	17.0	29	5:30	6:00
16	2	754.0	83.0	28.4	28.5	28.4	28.2	15.4	20	5:28	6:50
17	3	758.0	76.0	28.0	28.2	28.2	28.2	21.2	20	5:15	5:40
18	3	758.0	77.0	28.2	28.2	28.0	27.5	19.8	27	5:00	5:40

Table of Experimental Fishing [Ratak Chain] (Continued)

Station No.	Times: Take in line Start	Times: Take in line Finish	Bait	Catch: Big-eye	Catch: Yellowfin	Catch: Spearfish	Other	Disposition of Catch
1	7:10	8:20	squid 100	1 90 lbs. 1 33 lbs.			2 sharks	Used for food
2	7:20	8:50	"		1 41 lbs.		3 sharks	
3	8:00	9:00	120					
4	8:00	8:50	100					
5	7:00	8:00	100		2 83 lbs. 1 125 " 1 25 " 2 8 "		1 cybiid 2 sharks	Packed in oil
6	7:30	8:45	100	1 125 lbs.	1 37 lbs. 1 54 "			Packed in water
7	7:40	8:10	100					
8	9:30	10:40	120		1 83 lbs.			Packed in oil
9	7:14	8:37	100					
10	8:00	9:00	100					
11	7:25	8:40	80 squid 20 iwashi	1 16 lbs.				Used for food Note: Fish ate iwashi
12	7:00	8:10	100 squid					
13	8:00	9:00	"			1 sailfish 50 lbs.		Used for food
14	7:00	8:00	"		1 108 lbs.		1 shark	Packed in water
15	7:20	8:30	"		1 16 lbs.			Used for food
16	7:30	8:50	"	1 124 lbs.		1 broadbill 132 lbs. (mekajiki)		Packed in oil
17	7:00	8:45	"		1 33 lbs.			Used for food
18	7:00	8:20	"		1 41 lbs.		1 cybiid	" "
	Totals		squid 1,820 iwashi 20 tubs	5	14	2	10	